Notes on the Biology of *Stalachtis susanna* (Lycaenidae: Riodininae) with a Discussion of Riodinine Larval Strategies

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Abstract. This paper describes the larval biology of *Stalachtis susanna* (Riodininae) and compares riodinine larval strategies. The differences between solitary myrmecophilous and gregarious non myrmecophilous riodinine larvae are examined. The conclusions are as follows:

1. When food resources fail, late-instar *Stalachtis* larvae enter the prepupal stage, pupate, and emerge as dwarf adults, whereas myrmecophilous larvae will resort to cannibalism.

2. Species with gregarious larvae tend to be cluster egg layers, whereas myrmecophilous species lay eggs singly, with the possible exception of the genus *Audre*.

3. Solitary larvae are more likely to have obligate myrmecophilous relationships than gregarious larvae.

4. Myrmecophilous larvae are cryptically colored whereas gregarious species are aposemetic.

5. Observations on rates of parasitism do not indicate any clearcut advantages for solitary myrmecophilous versus gregarious behaviour.

Introduction

Stalachtis susanna (Fabricius, 1787) is a medium sized riodinine butterfly inhabiting tropical and subtropical forest habitats throughout southeastern Brazil. It is particularly common in secondary or disturbed forest. *S. susanna* has a reputation for being distasteful to predators as suggested by its slow flight and bright orange colors.

Notes on the life history of *S. susanna* have appeared in D'Araujo e Silva et al. (1967) and Zikan (1953). The former records the larvae as feeding on the leaves of angelim (*Andira* sp., Leguminosae) in Minas Gerais. Zikan gives a rather brief description of the larvae, pupae and habits. He does not name the foodplant.

The purpose of this paper is to describe the larval instars and habits of *S. susanna* and to compare the larval development and survival strategies with those of other riodinine species. Observations on the biol-

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ogy of this butterfly were made in a patch of secondary forest near Barra de São Joao, Rio de Janeiro State. The climax forest in this area is typical of the transition between the low, scubby restinga and the tropical Atlantic forest. The trees reach 10-12 meters in height and the understory consists mainly of bromelids typical of the restinga. In addition to field observations, larvae in various instars were reared and observed in the laboratory.

Description of Immature Stages

First Instar: Not available

Second Instar: Length 5.5 mm, head capsule 0.6 mm. Body rounded dorsally, flat ventrally. Color light yellow and brown with black markings. Head light brown, face with numerous small setae. First thoracic segment with a light brown saddle-shaped dorsal shield with ten long setae extending cephalad and smaller setae laterally; a spiracle on each side near junction with second thoracic segment; second and third thoracic segments with four transverse dorsal spots, each with one long and several short setae. Abdominal segments each with a black transverse bar dorsally with two long setae protruding from small tubercles and numerous short setae. Spiracles on A1-8 lateral, but more ventrally positioned on A1. On segments A9-A10 is a small dorsal plate. Duration 3 days.

Third Instar: Length 9 mm, head capsule 1 mm. Form and coloring same as second instar. Duration 4 days.

Fourth Instar: Length 13 mm, head capsule 2.5 mm. Head and first thoracic segment light orange, as are abdominal segments A9-A10, remaining segments darker orange; forelegs black. Transverse dorsal bars broken into two spots with one long white seta each; otherwise as in second instar. Duration 3 days.

Fifth Instar: Length 17 mm, head capsule 3 mm. Color overall darker orange; otherwise as in fourth instar. Duration 4 days.

Prepupal: (Fig. 1) Color turns uniform light orange with the two rows of dorsal spots reduced in size. Duration 3 days.

Pupa: (Figs. 2, 3) Length 17 mm, width at widest point (thorax) 6.5 mm. Color dark yellow with black maculation. Head yellow with two black spots and two lines between them. First segment of thorax with a dot at base of head and four short lines; thorax dorsad with a pair of black spots on each segment and two additional dots laterally; wing cases with costa and veins outlined in black. Abdominal segments each with two black spots dorsally; segments A2 and A4-A8 with an additional black spot on each side. Surface covered with small setae, each protruding from a small tubercle. Pupa secured by a silk pad and girdle. Duration 11 days.

Discussion

The foodplant of *S. susanna* in Barra de São Jõao is *Simaba glabra* Engl (Simaroubaceae), an endemic restinga plant. *S. glabra* grows as a small tree, reaching 3-4 meters in height. The glossy ovate leaves grow alternately on the branches. The *S. susanna* larvae were observed feeding on

Fig. 1. Prepupal larvae.
Fig. 2. Pupa, ventral view.
Fig. 3. Pupa, dorsal view.
Fig. 3. Female imagos. Bottom, normal female. Top, dwarf female.

new growth of the plant, the older leaves were tough and leathery and avoided by larvae.

The larvae are gregarious throughout their development. They feed by aligning side by side on the edge of the leaf, then moving backwards as they eat ravenously across the leaf. The most active feeding occurs at night, early morning and evening. During the heat of the day, the larvae retire down the stem of the foodplant. Larvae of the same instar feed together, but separated from larvae of different instars. They are usually segregated on separate leaves or on different parts of the same leaf. There was no aggressive behavior observed between larvae of different instars.

The larvae grow rapidly, reaching the prepupal stage in an estimated 15 to 18 days. Prepupal larvae cease feeding, leave the young leaves of the foodplant and align side by side on the ventral surface of a leaf or stem where they remain motionless, pupating three days later.

Larval survival strategy in the face of foodplant shortages was discovered quite by accident. Three laboratory reared *S. susanna* larvae had reached the fourth instar when the available foodplant ran out. After two days of wandering around the holding jar, they retired under a dried up leaf, ceased all activity for seven days until they pupated. The pupae were smaller than those of well-fed larvae and measured 13 mm in length instead of the normal 17-18 mm. The resulting imagos, (all females), were also smaller (Fig. 4), with wing lengths of 19 mm versus 26 mm for average females. Except for size, they showed no other differences from normal females. The developmental time from fourth instar to pupation (9 days), was about the same amount of time take by feeding larvae with available foodplant. These observations suggest that if the larvae are unable to find sufficient foodplant, they will advance immediately to the prepupal stage and complete their development on nutrients stored in their tissues. This phenomenon could account for the wide variation in size encountered among adults in some *susanna* populations, which led d'Almeida to give the name *pygmaea* d'Almeida, 1922, to the smaller individuals.

This strategy contrasts sharply with that of other riodinine larvae, especially solitary myrmecophilous species. Both *Juditha molpe* (Callaghan, 1982) and *Synargus brennus* (Callaghan, in press) practice cannibalism, eating smaller larvae or pupae, when foodplant is wanting. In this way, the larger larvae could have a better chance of successfully pupating.

It became evident during the course of this study that there were other significant contrasts between gregarious riodinine larvae and myrmecophilous solitary species. These are reviewed below.

1. Oviposition. Among Neotropical riodinines, myrmecophilous species lay eggs singly on the foodplant, whereas gregarious species oviposit in clusters. In addition to *J. molpe, S. brennus* and *Menander felsina* (Callaghan, 1977), I have observed oviposition by *Nymphidium* n.sp. and *Nymphidium ascolia*, both in Colombia; and *Juditha lamis* in Brazil. Similar observations have been made by W. Benson on *Nymphidium galactina* at Jaru, Rondonia (pers. comm.). In all cases, eggs of these myrmecophilous species were placed singly, apparently at random on the foodplant, usually on the stem near petioles. Eggs were often placed on plants with larvae in various instars, suggesting that larvae, eggs and pupae are free from predation by their late instar siblings except when plant resource becomes scarce. The only apparent exception is the genus

Audre of which I have found the larvae to be solitary and myr-
mecophilous, but which is said to lay eggs in small clusters (Bruch, 1926;
Robbins & Aiello, in press).

Cluster ovipositing is associated with gregarious behavior. Examples
are *Hades noctula* (Chew and Robbins, 1984), various species of the genus
Euselasia (Otero, pers. comm.; Hoffman, 1931; Kendall, 1976).

Neotropical riodinine ovipositing behavior in this respect contrasts
strongly with that of old world lycaenids. Kitching (1981) reported that in
Australia, egg clustering in lycaenid butterflies is almost always
associated with obligate myrmecophily, whereas only a third of those
species which oviposit singly had similar relationships.

2. Gregarious vs. solitary behavior. Obligate myrmecophilous behavior
is more likely to occur among solitary larvae than among gregarious
species. All myrmecophilous larvae I have observed are solitary. In addi-
tion to *J. molpe, J. lamis, S. brennus* and *M. felsina* cited earlier, *Audre
campestris* ssp. (Southern Brazil) and *Calospila* sp. (Choco, Colombia)
are also solitary and myrmecophilous. At times, myrmecophilous larvae
will appear to be gregarious in cases where food plant resources are con-
centrated, such as the new growth on stems of foodplants, or when being
"herded" by ants, as has been observed in *Lemonias caliginea* (Ross,
1966). However, even under these circumstances, larvae will disperse as
much as possible, one or two to a leaf, and never side by side as do
gregarious larvae. Conversely, gregarious larvae apparently are not myr-
mecophilous. Examples are *Euselasia eucerus* (Brun et al., 1977,
Euselasia hygenius, notes in the Museu Nacional collection), *E.
thucydides, Hades noctula* and *S. susanna.*

3. Protection strategies. Observations on Myrmecophilous larvae sug-
gest that they are cryptically colored with a flat profile enabling them to
avoid vertebrate predation by blending with background substrate. Ants
which accompany them may also serve to discourage predators.
Conversely, gregarious species tend to be aposematic with conspicuous
profiles, achieved through their active, gregarious feeding. They obtain
protection from many predators through distastefulness (Fisher, 1930;
Chew and Robbins, 1984).

4. Parasitism. Regarding solitary myrmecophilous vs. gregarious
riodine species, there is no conclusive evidence as to which suffer more
from parasitism. I have observed parasitism by ichneumonoid wasps in
individuals of *Synargus brennus* and *Calospila* sp., in spite of the pres-
ence of ants. Although some evidence suggests that gregarious larvae suf-
fer a lower rate of parasitism (Chew and Robbins, 1984), this may not be
true for riodines. Brun et al. (1977) reported rates of parasitism up to
31.6% among gregarious larvae of *Euselasia eucerus* by an ichneumonoid
wasp (Trichogramma sp.).

Finally, the foregoing discussion does not pretend to exhaust the possible larval strategies among riodinine butterflies. It does, however, underline the lack of information concerning the biology of these butterflies and the hope that others working with life histories and biology of Neotropical diurnal Lepidoptera will give riodinine butterflies more attention.

Literature Cited

BRUCH, C., 1926. Orugas mirmecofilas de Hamearis epulus signatus Stich. Rev. Soc. Ent. Argentina. 1:1-9.

BRUN, P., et al., 1977. Importance de Trichogramma sp. (Hym.: Trichogrammatidae) dans la biocoenose d'Euselasia eucerus (Lep.: Riodinindae) ravageur de l'eucalyptus. Entomophaga, 22(2):193-198.

CALLAGHAN, C. J., 1977. Studies on restinga butterflies I. Life cycle and immature biology of *Menander felsina*, (Riodinidae), a myrmecophilous metalmark. J. Lep. Soc. 31(3):173-182.

————, 1982. Notes on the immature biology of two myrmecophilous Lycaenidae: *Juditha molpe* (Riodininae) and *Panthiades bitias* (Lycaenidae). J. Res. Lep. 20(1):36-42.

————, in press. Studies on restinga butterflies III. The biology of *Synargus brennus* (Stichel, 1910) (Riodininae) J. Lep. Soc.

CHEW, F. & R. ROBBINS, 1984. Egg laying in butterflies, *in*: The biology of butterflies, Vane-Wright and Ackery, eds. Academic, London. 429 pp.

D'ARAUJO E SILVA, A. G., C. R. GONCALVES, D. M. GALVAO, A. G. L. GONCALVES, J. GOMES, N. SILVA & L. DE SIMONI, 1968. Quarto catalogo dos insetos que vivem nas plantas do Brasil—seus parasitos e predadores. Min. Agricultura, Rio de Janeiro, pp. 1-622, 1-264, 1-422, 423-906.

FISHER, R. A., 1930. The genetical theory of natural selection. Carendon, Oxford. 272 pp.

HOFFMAN, F., 1931. *Euselasia eucerus* Hew. (Erycinidae) Ent. Rundschau 48: 55-56.

KENDALL, R. O., 1976. Larval foodplants and life history notes for some metalmarks (Lepidoptera, Riodininae) from Mexico and Texas. Bul. Allyn Mus. 32, 12 pp.

KITCHING, R. L., 1981. Egg clustering and the southern hemisphere Lycaenidae: comments on a paper by N. E. Stamp. Am. Nat. 118(3):423-425.

ROBBINS, R. & A. AIELLO, in press. Foodplant and oviposition records for Panamanian Lycaenidae and Riodinidae. J. Lepid. Soc.

ROSS, G. W., 1966. Life history studies on Mexican butterflies IV. The ecology and ethology of *Anatole rossi*, a myrmecophilous metalmark. (Lepidoptera, Riodinidae) Ann. Ent. Soc. Amer. 59:985-1004.

ZIKAN, J. F., 1953. Beitrag zur Biologie von 19 Riodiniden Arten (Riodinidae, Lepidoptera). Dusenia 4(5,6):403-413.